Claims

[c1] A method for forming a gate structure for a semiconductor device, the method comprising:
defining a conductive sacrificial structure on a substrate;
forming a reacted metal film on sidewalls of said conductive sacrificial structure; and
removing unreacted portions of said conductive sacrificial structure.

[c2] The method of claim 1, further comprising forming a protective cap over said conductive sacrificial structure prior to forming said reacted metal film.

[c3] The method of claim 2, further comprising trimming a portion of said reacted metal film so as to define a pair of gate conductors that are electrically isolated from one another.

[c4] The method of claim 1, wherein said conductive sacrificial structure further comprises at least one of: cobalt, nickel, titanium, tantalum, palladium and platinum.

[c5] The method of claim 4, wherein said reactive metal film further comprises at least one of: cobalt silicide, cobalt nitride, nickel silicide, nickel nitride, titanium silicide and

titanium nitride.

[c6] The method of claim 1, wherein said reacted metal film is formed by reacting said conductive sacrificial structure with a reactive gas in the presence of heat.

[c7] The method of claim 1, wherein said reacted metal film is formed by annealing sidewall spacers formed on said conductive sacrificial structure, said sidewall spacers comprising a thermally reactive material with respect to said conductive sacrificial structure.

[c8] A method for forming a gate structure for a semiconductor device, the method comprising:
forming a gate dielectric material on a substrate;
forming an etch stop layer over said gate dielectric material;
forming a conductive layer over said etch stop layer;
forming a protective layer over said conductive layer;
patterning and removing portions of said protective layer and said conductive layer so as to define a conductive sacrificial structure and a protective cap thereupon;
forming a reacted metal film on sidewalls of said conductive sacrificial structure by reacting said conductive sacrificial structure with a reactive gas in the presence of heat; and
removing at least a portion of said protective cap, re-

moving exposed, unreacted portions of said conductive sacrificial structure, and removing exposed portions of said etch stop layer.

[c9] The method of claim 8, further comprising trimming a portion of said reacted metal film so as to define a pair of gate conductors that are electrically isolated from one another.

[c10] The method of claim 9, wherein said trimming further comprises:
removing a portion of said protective cap and said reacted metal film, thereby reexposing at least one of said sidewalls of said conductive sacrificial structure; and
isotropically etching said reexposed conductive sacrificial structure.

[c11] The method of claim 10, wherein unexposed portions of said conductive sacrificial structure are remaining in one of said pair of gate conductors, thereby defining a wider gate structure with respect to the other of said pair of gate conductors.

[c12] The method of claim 8, wherein said reactive gas further comprises at least one of: SiH_4, NH_3 and N_2 plasma.

[c13] The method of claim 12, wherein said reactive metal film further comprises at least one of: cobalt silicide, cobalt

nitride, nickel silicide, nickel nitride, titanium silicide and titanium nitride.

[c14] A method for forming a gate structure for a semiconductor device, the method comprising:
forming a gate dielectric material on a substrate;
forming an etch stop layer over said gate dielectric material;
forming a conductive layer over said etch stop layer;
forming a protective layer over said conductive layer;
patterning and removing portions of said protective layer and said conductive layer so as to define a conductive sacrificial structure and a protective cap thereupon;
forming a reacted metal film on sidewalls of said conductive sacrificial structure by annealing said conductive sacrificial structure and a thermally reactive layer formed in contact with said sidewalls of said conductive sacrificial structure; and
removing said protective cap, removing unreacted portions of said conductive sacrificial structure and said thermally reactive layer, and removing exposed portions of said etch stop layer.

[c15] The method of claim 14, further comprising trimming a portion of said reacted metal film so as to define a pair of gate conductors that are electrically isolated from one another.

[c16] The method of claim 15, wherein said conductive sacrificial structure further comprises at least one of: cobalt, nickel, titanium, tantalum, palladium and platinum.

[c17] The method of claim 16, wherein said thermally reactive layer further comprises a silicon layer.

[c18] The method of claim 17, wherein said reactive metal film further comprises at least one of: cobalt silicide, nickel silicide and titanium silicide.

[c19] The method of claim 14, wherein said etch stop layer further comprises at least one of: tungsten, tantalum nitride, tungsten silicide, tantalum silicide, palladium, silicide, platinum silicide and titanium silicide.

[c20] The method of claim 14, further comprising forming sidewall spacers from said thermally reactive layer prior to annealing thereof.